Mathematics Toolkit: Grade 6 Objective 5.C.1.a

Standard 5.0 Knowledge of Probability

Topic C. Experimental Probability

Indicator 1. Analyze the results of a probability experiment

Objective a. Make predictions and express the experimental probability as a fraction, a decimal, or a percent

Assessment Limits:

Use no more than 30 results in the sample space

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Clarification

Mathematics Grade 6 Objective 5.C.1.a Assessment Limit 1

Experimental probability is the estimated probability based on the observed number of times (frequency) an event occurs. Many times the theoretical probability of the occurrence of an event cannot be obtained and we then must rely on this observed estimated probability to make predictions. Even when the theoretical probability can be obtained, it is important that we understand that the experimental probability of an event approaches that of the theoretical probability of the event as the number of trials (observations) in the experiment increases.

Classroom Example 1

Luis has 10 cards lettered A through J with one letter on each card. Luis shuffles the cards and picks one card without looking. He replaces the card, shuffles the cards, and picks again. Luis does this 30 times. The data below shows which card Luis picked each time.

B	C	F	G	D	A
C	J	H	J	I	C
D	F	G	E	D	F
A	F	D	J	G	H
I	E	F	F	G	H

What is the experimental probability of drawing a card lettered F?

Answer: The correct answer can be expressed in equivalent forms:

$\frac{6}{30}$ $\frac{2}{10}$ $\frac{20}{100}$ 20% 0.2 0.20

What is the theoretical probability of drawing a card lettered F?

Answer: The correct answer can be expressed in equivalent forms:

$\frac{1}{10}$ $\frac{10}{100}$ 10% 0.1 0.10

Compare the experimental probability of drawing a card labeled F to the theoretical probability of drawing a card labeled F. Which is larger? Why do you think that is true?

Answer: The experimental probability is larger. Students should explain that the number of trials is small. As the number of trials gets larger, the theoretical probability should be close in value to the experimental probability.

Predict the number of times you should draw a card lettered F in 100 draws.

Answer: 10
The prediction should be based on the theoretical probability, no matter how many

times cards marked with the letter F have been drawn previously. The cards have no memory of prior draws.

Sample Item #1 - Selected Response (SR) Item

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Kathy tosses a penny 24 times. The penny lands either with the head side showing or the tail side showing. The data below shows how the penny lands each time.

Heads	Tails	Heads	Tails
Tails	Tails	Heads	Tails
Tails	Tails	Tails	Tails
Heads	Heads	Tails	Heads
Tails	Tails	Tails	Tails
Tails	Tails	Tails	Tails

Kathy tosses the penny 100 more times. Based on the experimental probability determined from the data, what percent of times do you expect the penny will land on heads?

A. 18%
B. 25%
C. 42%
D. 75%

Correct Answer:
B

Sample Item #2 - Selected Response (SR) Item

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Jenn is practicing her basketball shooting. She took 25 practice shots and her results are listed below.

Made	Missed	Missed	Made	Made
Missed	Made	Made	Missed	Missed
Missed	Made	Made	Made	Made
Made	Missed	Made	Missed	Made
Made	Made	Missed	Made	Missed

Based on the results, what is the experimental probability she will make the next shot?

A. 10%
B. 15%
C. 40%
D. 60%

Correct Answer:
D

Answer Annotation

A. 10% (10 shots missed)
B. 15% (15 shots made)
C. 40% (probability of missing)
D. 60% (correct answer)

Sample Item #3 - Selected Response (SR) Item

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Marla rolled a number cube 30 times and her results are shown below.

4 5 1 3 6 3 4 2 3 5

1 2 2 2 6 5 3 5 4 1

6 5 2 3 4 1 5 3 3 1

Based on her results, what is the experimental probability that Marla will roll an even number on her next roll?

A. 0.12
B. 0.18
C. 0.40
D. 0.60

Correct Answer:
C

Answer Annotation

A. 0.12 (number of even rolls)
B. 0.18 (number of odd rolls)
C. 0.40 (correct answer)
D. 0.60 (probability of rolling an odd number)

Sample Item #4 - Brief Constructed Response (BCR) Item

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Juan flipped a coin 20 times. The results are listed below.

Heads	Tails	Tails	Tails	Heads
Tails	Heads	Tails	Heads	Tails
Heads	Tails	Heads	Tails	Heads
Tails	Tails	Tails	Heads	Heads

Step A

Based on Juan's results, what is the experimental probability that the coin will land on heads the next time it is flipped?

Step B

Explain why your answer is correct. Use what you know about probability in your explanation. Use words, numbers, and/or symbols in your explanation.

Answer Annotation

Step A Answer: $\frac{9}{20}$ or any equivalent form.

Step B Sample correct response: Since Juan flipped heads nine times out of 20, the number of favorable outcomes is nine and the total number of possible outcomes is 20. So the probability is 9 out of 20, or 45%.

Rubric - Brief Constructed Response (BCR)

Score 2
The response demonstrates a complete understanding and analysis of a problem.

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate. [3]

Score 1
The response demonstrates a minimal understanding and analysis of a problem.

- Partial application of a strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate.[3]

Score 0
The response is completely incorrect, irrelevant to the problem, or missing.[4]

Notes:

[1] Explanation refers to students' ability to communicate how they arrived at the solution for an item using the language of mathematics.

[2] Justification refers to students' ability to support the reasoning used to solve a problem, or to demonstrate why the solution is correct using mathematical concepts and principles.

[3] Students need to complete rubric criteria for *explanation, justification, connections* and/or *extensions* as cued for in a given problem.

[4] Merely an exact copy or paraphrase of the problem will receive a score of "0".

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